An integrated job stress model in workplace

Y. H. Lee¹, S. D. Lee¹, Y. S. Kim²

¹ Department of Industrial Management Engineering, Dong-A University, Busan, Korea

² Department of Human Ecology, Kyungsung University, Busan, Korea
yonghee@donga.ac.kr

Abstract

This paper evaluates stress factors to effect on jobs and develops the evaluation model to apply the manufacturing workplaces. There are many psychosocial approaches and risk assessment tools to evaluate a job stress and musculoskeletal complaints that are attributed to hazardous occupations, but the exact etiology of these stress/disorders are currently unclear. The researches, however, indicate that these problems are multi-factorial and complicated with physical, psychosocial and environmental factors. Therefore we developed the integrated model considering those factors for the job stress evaluation in manufacturing workplaces.

Keywords: job stress, musculoskeletal disorders, psychosocial factors, integrated job stress questionnaire

Introduction

The issue of job stress and ergonomic assessment of risk factors associated with musculoskeletal injuries have received much attention from researchers and practitioners for years, and a number of methodologies have been studied in the research community. Job stress due to downsizing and restructuring the company leads to develop both mental disorder and physical illness of Korean workers. It is strongly required that systemic studies to grasp the whole picture of current situation for job stress and to clarify its associated risk factors should be performed.

Although the level of job stress and the detailed risk factors may vary, risk assessment methods can be categorized into two groups: macro-ergonomic and micro-ergonomic risk assessment. Limited research has been conducted with respect to development and testing of macro-risk assessment procedures (Lin *et al.*, 1996). The use of such techniques will become an important component of a health surveillance process due to the anticipated promulgation of ergonomic standards in various countries around the world.

Over the past 20 years, a number of researchers have raised concerns regarding the reliance on self-reports of psychosocial work conditions for measuring job strain (Frese and Zapf, 1988; Kasl, 1978, 1987, 1998). One hundred and forty supervisors in 18 different departments used the job contents questionnaire (JCQ, Karaseck, 1985) to estimate psychosocial work conditions for the jobs of 8,838 civil servants. Based on this investigation, men and women with self-reported low-job-control had about 1.5 to 1.9 times for the risk of developing new CHD compared with participants with high control (Ostry *et al.*, 2001). Also, Keyserling *et al.* (1992) developed a checklist to identify the risk factors for awkward postures of legs, trunk and neck of a participant. Keyserling *et al.* (1993) designed another checklist to assess risks for upper extremity cumulative trauma disorders. In order to assess ergonomic stresses in the workplace, Lin *et al.*

(1996) developed a macro-ergonomic risk assessment tool. Macro-ergonomic approach implies the consideration of the organizational/social, technological and physical work related subsystems (O'Neil, 1998).

Many researchers studied and developed a checklist related to work-related muscular skeletal disorders (WMSDs), cumulative trauma disorders (CTDs) and work-related upper extremity (WRUE) symptoms. The exact etiology of these symptoms/disorders is currently unclear. The research, however, indicates that this problem is multi-factorial in development and therefore likely to be complicated in terms of prevention and treatment (National Research Council and the Institute of Medicine, 2001; Devereaux *et al.*, 2002). There are also psychosocial approaches, such as job content questionnaire (JCQ), generic job stress questionnaire (GJSQ) and macro-ergonomic risk assessment tool to enhance workers' safety and health. However, they are not different looking at the job stress from a holistic angle because an organization, human and the relationship between human and an organization are so organismic. Therefore we developed the integrated model considering psychosocial, physiological and environmental factors for job stress evaluation in manufacturing workplace.

Method and material

As shown in Table 1, various stress factors from JCQ, GJSQ, Jang's questionnaire, O'Neil's checkpoints and the proposed integrated job stress questionnaire (IJSQ) can be classified by three factors (i.e., physical, psychosocial, environmental factors). Although the majority of previous studies concentrated on psychosocial and few environmental factors, physical factors were not often incorporated into job stress. For example, JCQ consisted psychosocial factors, GJSQ considered psychosocial and environmental factors, O'Neil's checkpoints dealt with psychosomatic and physiological stress for office workers. However, the proposed IJSQ incorporates all physical, psychosocial

and environmental factors. For verification purposes, an evaluation of the relationships among those factors should be performed. The proposed IJSQ composes various factors shown in Table 1 and checkpoints made from problem factors tree of O'Neil and consists 4 likert type questions including 6 items: (1) general factors, (2) physical factors, (3) psychosocial factors, (4) environmental factors, (5) evaluation of WMSDs, (6) job satisfaction. In this study, we investigated work environment and surveyed workers in manufacturing workplace to compare preceding questionnaires and IJSQ. The correlation analysis between physical, psychosocial, environmental factors and the evaluation of WMSDs was performed to evaluate factors affecting WMSDs.

The company consisting approximately 200 workers produces marine switchboards (45%), control consoles (35%) and thrusters (20%) etc. The manufacturing processes include assembly (over 85 %), welding and painting. In order to estimate the results, we conduct a comparative study for the proposed IJSQ and other current methods using SPSS (ver 10.0).

Table 1 Stress Factors used in IJSQ

Physiological factors
lack of adjustable wrist rests ¹⁾ , simpler repetitive tasks ¹⁾⁵⁾ , proper work surface ⁵⁾ , using vibrators ⁵⁾ , treatment with heavy things ⁵⁾ , needs to put force ⁵⁾ , uncomfortable posture ³⁾⁵⁾
Psychosocial factors
Increased need for job vigilance ¹⁾³⁾ , increased stringent performance standards ¹⁾²⁾³⁾⁴⁾ , increased job repetition ¹⁾²⁾ , increased job regimentation ¹⁾ , increased job boredom ¹⁾ , increased rigid work procedures with high production standards ¹⁾²⁾³⁾ , decreased work challenge ¹⁾²⁾³⁾ , increased dehumanization of job activity ¹⁾²⁾³⁾⁴⁾ , little identification with and satisfaction from the end products of worker's job activity ¹⁾ , insufficient number and length of rest breaks ¹⁾³⁾ , increased job monotony ¹⁾ , decreased job autonomy ¹⁾²⁾³⁾⁴⁾ , decreased job security ¹⁾ , decreased career development ¹⁾³⁾ , decreased peer cohesion and staff support ¹⁾²⁾³⁾⁴⁾ , increased strained management/employee relations ¹⁾²⁾³⁾ , increased job future uncertainty ¹⁾²⁾³⁾⁴⁾ , decreased participation in job decisions ¹⁾²⁾³⁾⁴⁾ , decreased job/task control by worker ¹⁾²⁾³⁾⁴⁾ , increased work pace ¹⁾²⁾³⁾⁴⁾ , increased work pressure ¹⁾²⁾³⁾⁴⁾ , increased supervision ¹⁾ , increased role ambiguity ¹⁾ , increased anxiety of computers replacing operator's role/job, decreased self-esteem ¹⁾ , evaluation of occupation ²⁾³⁾⁴⁾ , amount of much tasks ²⁾³⁾⁴⁾ , not enough time for tasks ²⁾³⁾⁴⁾ , requirement or demand forcibly from others ²⁾³⁾⁴⁾ , knowledge and technology for tasks ²⁾³⁾ , needs of creative ability ²⁾³⁾ , needs of high technology ²⁾³⁾ , various tasks ²⁾⁴⁾ , opportunity of ability development ²⁾³⁾ , a higher officer's concern about followers' welfare ²⁾³⁾⁴⁾ , a higher officer's concern about followers' talk ²⁾³⁾⁴⁾ , a higher officer's help for followers' task ²⁾³⁾⁴⁾ , a higher officer's leadership ²⁾³⁾⁴⁾ , capable colleagues at their fields ²⁾ , colleagues' concern ²⁾³⁾ , colleagues' kindness ²⁾³⁾ , colleagues' friendly help ²⁾³⁾⁴⁾ , responsibility for colleagues or followers ³⁾⁴⁾ , changed relevant facts with

tasks often³⁾⁴⁾, fairness of personnel affair such as duty appraisalment, promotion, positioning etc. ³⁾⁴⁾, appropriateness of position compared with education and career³⁾⁴⁾, job falling short of expectation³⁾⁴⁾, appropriateness of payment reflecting to an effort and achievement³⁾⁴⁾, interest of present tasks³⁾⁴⁾, uncomfortable dining together³⁾, task indication without consistency³⁾⁴⁾, the atmosphere of the office with vertical authority³⁾, disadvantage from sexual difference³⁾

Environmental factors

Nonadjustable work surface height¹⁾, storage inappropriate to task¹⁾, lack of adjustable and self-controlled task lighting¹⁾, lack of easily reconfigurable interior layout, keyboard height and position nonadjustable¹⁾, nonadjustable or lack of document holder¹⁾, improper workchair that lacks swivel, tilt, height adjustment, adjustable backrest, removable armrests, and rolling casters¹⁾, nonadjustable shelving¹⁾, insufficient size of work surface and/or lack of additional work surfaces¹⁾, lack of natural soft glare-free indirect light¹⁾⁴⁾, improper seal design (low, soft, <45cm)¹⁾, improper ventilation with currents of air that blow directly on employee¹⁾⁴⁾, improper humidity levels (<50% >60%)¹⁾⁴⁾, improper temp. levels (<68F or in winter and <73F >81F in summer)¹⁾⁴⁾, improper design of keyboard layout shape of key¹⁾, improper layout of desk and of terminal¹⁾, lack of, or improper foot support¹⁾, improper heal up from under work surface¹⁾, improper surface temperature for external contact surfaces¹⁾, too close of proximity to others creates feelings of crowding¹⁾⁴⁾, improper enclosures that don't ensure acoustical control of noise disturbances¹⁾⁴⁾, lack of enclosure for complex tasks¹⁾, increased alienation and isolation from others¹⁾, nonadjustable HVAC¹⁾, lack of adjustable and self-controlled task lighting¹⁾, lack of easily reconfigurable interior layout¹⁾, cleanliness³⁾⁴⁾, smoothness of the resources such as the personnel, space, equipment, instrument, training etc. ³⁾⁴⁾, exposure to dangerous materials⁴⁾

¹⁾ O'Neill ²⁾ Karasek ³⁾ Jang ⁴⁾ NIOSH ⁵⁾ IJSQ

Results

Table 2 shows the basic statistics about the degree of job stress and the satisfaction of job in each questionnaire. The results of the proposed IJSQ and the current methods provide similar values in mean and S.D., same as the correlation analysis except JCQ (p=0.344). In case of JCQ, the correlation coefficient value was 0.217 and lower than the others. It might be resulted from the job characteristics in this study. The satisfaction of subjects is more affected by physical and environmental factors than psychosocial factors because all subjects are engaged in heavy work related to marines. As shown in Table 3 and Table 4, the possibility of the proposed IJSQ can be proved through the correlation analysis indicating IJSQ (p=0.006) which is the second lowest p-value among five types of questionnaires and p=0.0001 which is the lowest p-value.

In the correlation analysis to evaluate factors affecting WMSDs (Table 5), the psychosocial (0.595**) and the environmental (0.487**) factors have influence on

WMSDs. Namely, WMSDs are affected by not only physical factors but psychosocial and environmental factors.

Table 2 The mean and S.D. of job stress and satisfaction

Type of questionnaire	The degree of job stress		The satisfaction of job	
	Mean	S.D.	Mean	S.D.
Check list from O'Neil	2.69	0.38	2.20	0.33
JCQ	2.47	0.24		
Jang's quest.	2.42	0.26		
GJSQ	2.43	0.25		
IJSQ	2.48	0.28		

Table 3 The result of Pearson's correlation analysis by the each evaluation model and job satisfaction

Type of questionnaire	Pearson's coefficient	p-value
O'Neil	0.511*	0.018
JCQ	0.217	0.344
Jang's quest.	0.557**	0.009
GJSQ	0.648**	0.001
IJSQ	0.583**	0.006

Table 4 The result of Pearson's correlation analysis by the each evaluation model and WMSDs

Type of questionnaire	Pearson's coefficient	p-value
O'Neil	0.7251**	0.0002
JCQ	0.2583	0.2583
Jang's quest.	0.5828**	0.0056
GJSQ	0.6098**	0.0056
IJSQ	0.7462**	0.0001

Table 5 The result of Pearson's correlation analysis by the physical, psychosocial and environmental factors and WMSDs

Factors	Pearson's coefficient	p-value
Physical	0.960**	0.000
Psychosocial	0.487*	0.025
Environmental	0.595**	0.004

Discussion

In this paper, we proposed an IJSQ model utilizing various factors, which provided similar solutions to

other current methods in basic statistics and correlation analysis. However, the proposed model was restricted to subjects who engaged in heavy work. For further research, it is needed to investigate various manufacture industry workers and measure the quantitative data using the physiological, psychological and epidemiological methods.

Reference

[1] Devereaux J.J., Vlachonikolis I.G., Buckle P.W.: Epidemiological study to investigate potential interaction between physical and psychosocial factors at work that may increase the risk of symptoms of musculoskeletal disorder of the neck and upper limb, Occupational and Environmental Medicine, 59(4): 269-277, 2002

[2] Karasek R., Gordon G., Pietrokovsky C. Rrese M., Pieper C., Schwartz J., Fry L., Schirer D.: Job Content Questionnaire: Questionnaire and user's guide, Lowell: University of Massachusetts, 1985

[3] Karasek R.A. and Theorell T.: Healthy Work: Stress, Productivity and the Reconstruction of Working Life, New York: Basic Books, 1990

[4] Kasl S.V.: Measuring job stressors and studying the health impact of the work environment: An epidemiologic commentary, J Occupational health Psychology. (3): 390-401, 1998

[5] Keller K., J. Corbett, D. Nichols: Repetitive strain injury in computer keyboard users: pathomechanics and treatment principles in individual and group intervention, Journal of Hand Therapy, 11(1): 9-26, 1998

[6] Keyserling W. M., Brouwer, M. L. and Silverstein, B.: A checklist for evaluating ergonomic risk factors resulting from awkward postures of the legs, trunk and neck, Int J Industrial Ergonomics, (9): 283-301, 1992

[7] Keyserling W. M., Stetson D. S., Silverstein B. A. and Brouwer M. L.: A Checklist for evaluating ergonomic risk factors associated with upper extremity cumulative trauma disorders, Ergonomics, (36): 807-831, 1993

[8] Lin G., Ash G., Doran C., Kevin H.: Macro-ergonomic risk assessment in nuclear remediation industry, Applied ergonomics, (27): 241-254, 1996

[9] Loisel, P., L. Gosselin, P. Durand, J. Lemaire, S. Poitras, L. Abenhaim: Implementation of a participatory ergonomics program in the rehabilitation of workers suffering from subacute back pain, Applied Ergonomics, (32): 53-60, 2001

[10] Marita C., Jan F. and Christer S.: Task design, psycho-social work climate and upper extremity pain disorderseffects of an organisational redesign on manual repetitive assembly jobs, Applied ergonomics, (30): 463-472, 1999

[11] Michael J. S. and Pascale C. S.: A balance theory of job design for stress reduction, International Journal of Industrial Ergonomics, (4): 67-79, 1989